

REMARKS

Claims 20-37 are now pending in the application. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

Claim 20 has been amended to clarify the claimed invention. Applicants submit that this amendment is consonant with amendments and arguments previously presented; does not add new matter or require further consideration, and will place the application in condition for allowance and/or in better form for appeal. Support for the amendment to Claim 20 is found in Applicant's specification at Paragraphs 16 and 43, for example. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and the following remarks.

REJECTION UNDER 35 U.S.C. § 103

Claims 20-37 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ayers (U.S. Pat. No. 4,466,869) (hereinafter "Ayers"), in view of Deng et al. Study of Sputter Deposition of ITO Films for A-Si:H N-I-P Solar Cells, in Proceedings of 2nd World Conference and Exhibition on Photovoltaic Solar Energy Conversion, pp. 700-703 (1998) (hereinafter "Deng"). This rejection is respectfully traversed.

As discussed above, independent Claim 20 has been amended to recite a corrosion resistant ITO layer in the form of a highly oriented film that further has a thickness of greater than 3000 Angstroms. Independent Claim 23 recites a corrosion resistant ITO layer in the form of a highly oriented film.

At the outset, Applicants respectfully submit that a *prima facie* case of obviousness has not been established for either independent Claims 20 or 23, as each

element of the recited elements of these claims are not present in the cited references. Neither the Ayers nor Deng references disclose corrosion resistant ITO films having a highly oriented structure for use in a semiconductor layer in a photoelectrochemical device. An obviousness rejection cannot properly rely upon purported inherent disclosure of a secondary reference. Further, there is no objective teaching or suggestion in either of the cited references to modify them in such a manner as to arrive at the claimed invention. Rather, the disclosure of both Ayers and Deng teach away from making any modifications that might arrive at the claimed invention. In this regard, the teachings of the cited references highlight the non-obviousness of the claimed subject matter.

Firstly, Applicants respectfully disagree that the Deng reference discloses the "same processing conditions" that form Applicants' unexpectedly corrosion-resistant ITO highly oriented films of the presently claimed invention or that Deng inherently discloses the presently claimed invention. As detailed in the present specification, there are specific conditions which facilitate the formation of highly oriented films that are suitable for corrosion resistance, including among other things, a deposition time of about 60 minutes or longer and deposition occurring in an atmosphere that is substantially free of oxygen. None of the wide variety of processing conditions set forth in Deng corresponds to a duration of deposition of greater than 30 minutes. Further, Deng is entirely silent as to the partial pressure of oxygen that must be maintained in the argon atmosphere, including the importance of preventing even small amount of diluents or contaminants which can prevent formation of a highly oriented film. Therefore, the Deng conditions do not appear to produce highly oriented films. The Ayers reference

likewise lacks any disclosure of producing highly oriented and/or corrosion resistant ITO films in a photoelectrochemical device.

Inherency may not be established by probabilities or possibilities. *Continental Can v. Monsanto*, 20 USPQ.2d 1746,1749 (Fed. Cir. 1991). The mere fact that a certain thing may result from a given set of circumstances is not sufficient. *Id.* Deng has no disclosure of highly oriented ITO materials. Further, there is no indication that the processing conditions listed in Deng could even form the materials used as corrosion-resistant ITO layers in a photoelectrochemical (PEC) device of the present invention, nonetheless that such conditions would form such materials without any uncertainty, as is necessary to establish inherent disclosure.

Additionally, inherency is distinct from obviousness and obviousness cannot be predicated on what is unknown. *In re Spormann*, 150 USPQ 449, 452 (CCPA 1966). The inherency of an advantage and its obviousness are entirely different questions, because something that may be inherent in a reference is not necessarily known. *Id.* Deng cannot form the basis for a proper obviousness rejection for alleged inherent disclosure of an unidentified and speculative composition formed via processing conditions that are not even disclosed.

Secondly, Deng and Ayers lack any suggestion to make the modifications necessary to arrive at the presently claimed highly oriented corrosion resistant films. Of the plethora of different processing conditions set forth in Deng, there is no guidance or suggestion in Deng (or Ayers for that matter) to modify any of processing conditions in such a manner as to form ITO films having a highly oriented morphology capable of providing the corrosion resistance of Applicants' invention.

There is simply no teaching, suggestion, or motivation in Deng or Ayers to increase deposition times to produce a thicker ITO layer. Nor does Deng provide any motivation or suggestion to create an ITO film having a highly oriented morphology. Rather, Deng teaches that a desirable thickness of an ITO film for use in an amorphous silicon electrode is 65-75 nm for necessary antireflection and to ensure that the sheet resistance is less than 80 Ohms/cm² for sufficient efficiency and performance. See e.g., Deng at First Paragraph, First Column, Page 701 and Third Paragraph, Second Column, Page 701. As is well recognized by those of skill in the art, a thicker layer of material increases electrical resistance, hence reducing electrical performance and efficiency. Thus, if a skilled artisan considered the teachings of Deng in their entirety, fully considering the stated objectives of Deng to improve performance and efficiency of photoelectrodes, there is no motivation whatsoever to increase deposition time beyond 30 minutes and/or to increase thickness of an ITO film, which would thereby increase resistance, reduce efficiency, and reduce overall performance.

Lastly, obviousness should be determined by evaluating the claimed invention as a whole. *Lear Sielger, Inc. v. Aeroquip Corp.*, 221 USPQ 1025, 1033 (Fed. Cir. 1984). The claimed invention as recited in Claims 20 and 23, arose by recognition that in a photoelectrochemical device that generates hydrogen, a photoelectrode comprising a conventional ITO semiconductor layer that contacts an electrolyte solution comprising a base will be exposed to corrosive anodic production of oxygen thereby potentially causing rapid corrosion of the ITO layer. At least some of the inventive aspects of the presently claimed invention relate to the discovery that specific materials, namely highly oriented corrosion resistant ITO films, are capable of reducing corrosion caused at such a photoelectrode, thereby providing a photoelectrochemical device with an improved

lifetime. As such, the inventive aspects of the claims rest not only in particular elements recited in each of the claims, but further are present in the whole device as claimed, including the individually recited elements. Thus, the incorporation of a corrosion-resistant highly oriented ITO film into a photoelectrode within a photoelectrochemical device is novel and non-obvious, in light of the cited art.

Neither the Ayers reference, nor the Deng reference, either independently or as combined, provides any disclosure, motivation or suggestion to arrive at the subject matter claimed in independent Claims 20 and 23, or the claims that depend therefrom, namely Claims 21-22 and 24-37, respectively. Applicants respectfully submit that neither the Ayers nor Deng references, either combined or individually, render Claims 20-37 obvious, and respectfully request reconsideration of these claims.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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